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Division of Ecosystem Analyses

Department of Matter and Energy Fluxes

Marian Pavelka and colleagues

OP Výzkum a vývoj pro inovace
2007-13

MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

EVROPSKÁ UNIE
EVROPSKÝ FOND PRO REGIONÁLNÍ ROZVOJ
ŠANCE PRO VÁŠ ROZVOJ

What is the research area of the team?

- **Long-term monitoring of greenhouse gases fluxes and meteorological elements** (infrastructure of atmospheric station and network of ecosystem stations)

- **Understanding of physiological processes** (level cell – individual – ecosystem) **affecting ability of ecosystems to bind atmospheric carbon**

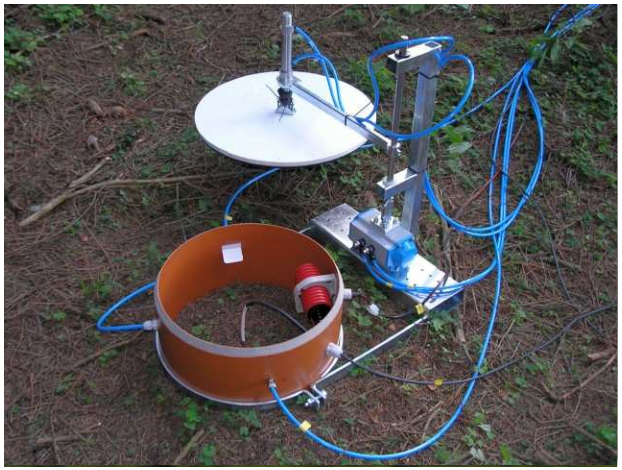
- **Quantification and dynamics of ecosystem CO_2 fluxes and model estimation of future development and upscaling into the CR scale**

- Description of **ecosystems' adaptation to global climate change and a proposal of arrangements that will reduce negative impacts and increase the ability of ecosystems to bind CO_2** from atmosphere

Methods description

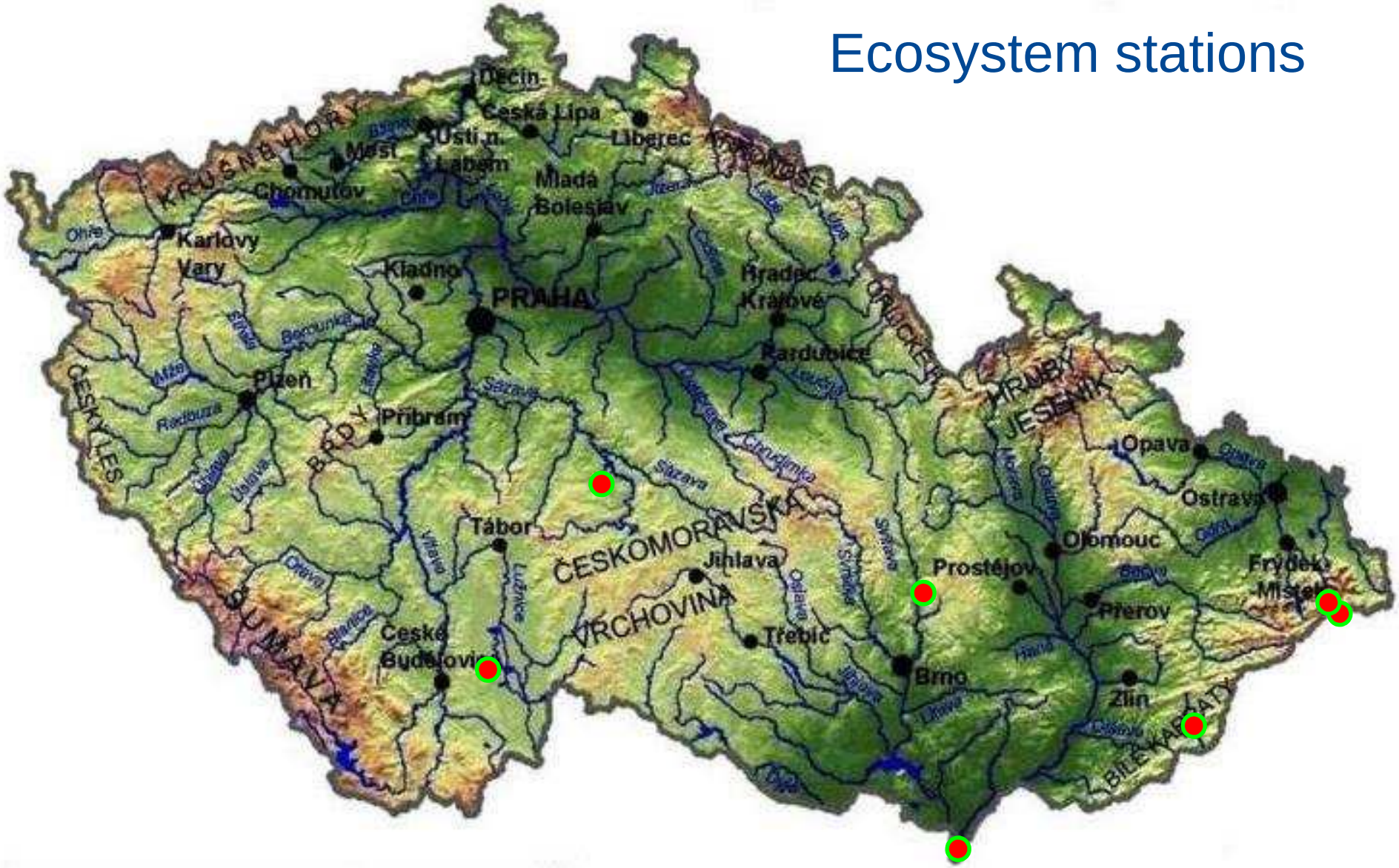
Ecosystem stations (ES):

- GHG fluxes – especially CO_2, N_2O, CH_4
- energy fluxes
- other parameters:
  - » vertical CO_2 concentration profile in air and soil
  - » water balance
  - » radiation balance
  - » carbon stock in vegetation and soil
  - » meteorological elements (Ta, Ts, Rh, WS, SM, precipitations, radiation…)
  - » tree transpiration flow (heat pulse method)
  - » nitrogen inputs
  - » phenology cameras
  - » litterfall amount
  - » biomass inventory…

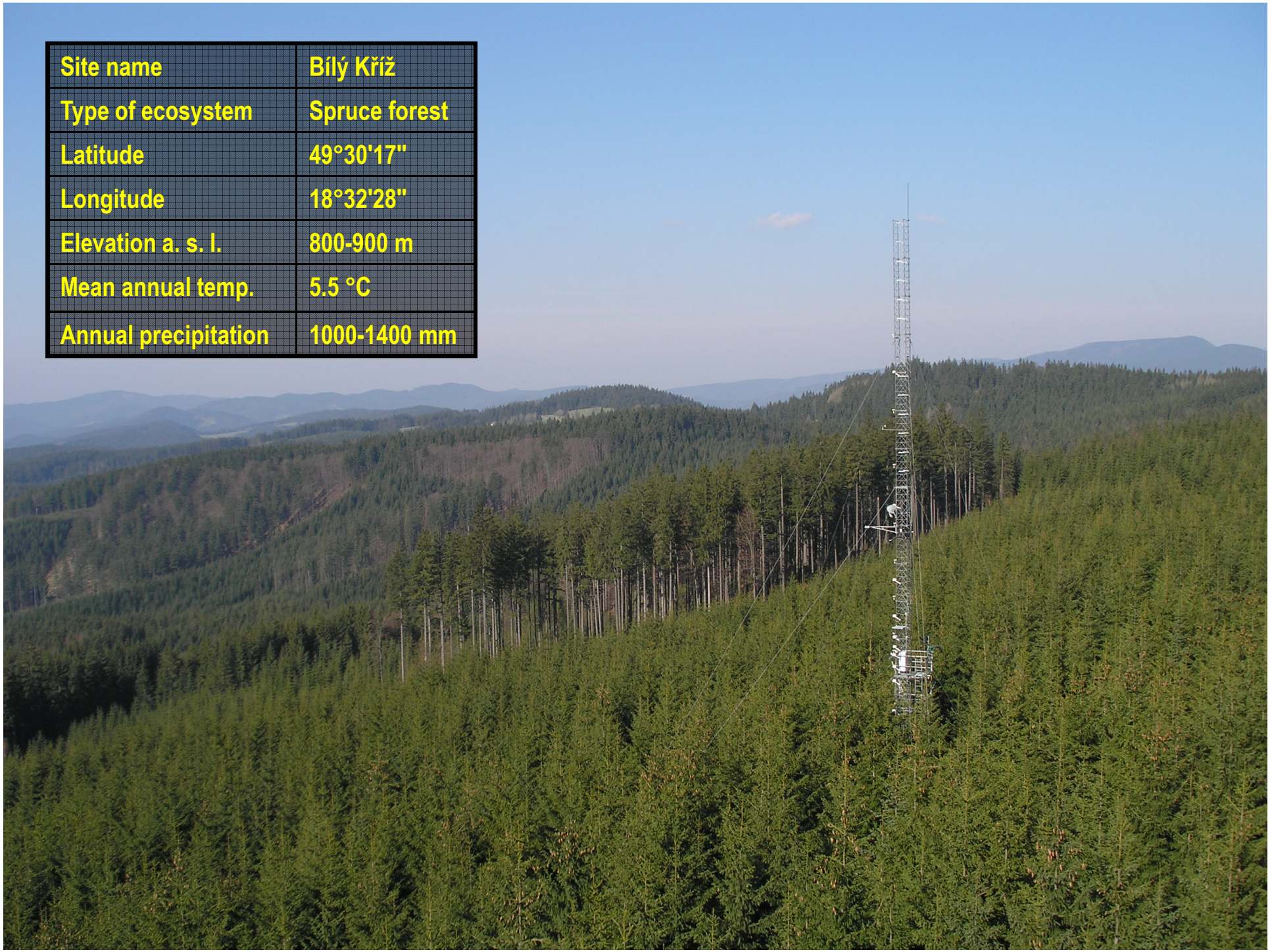


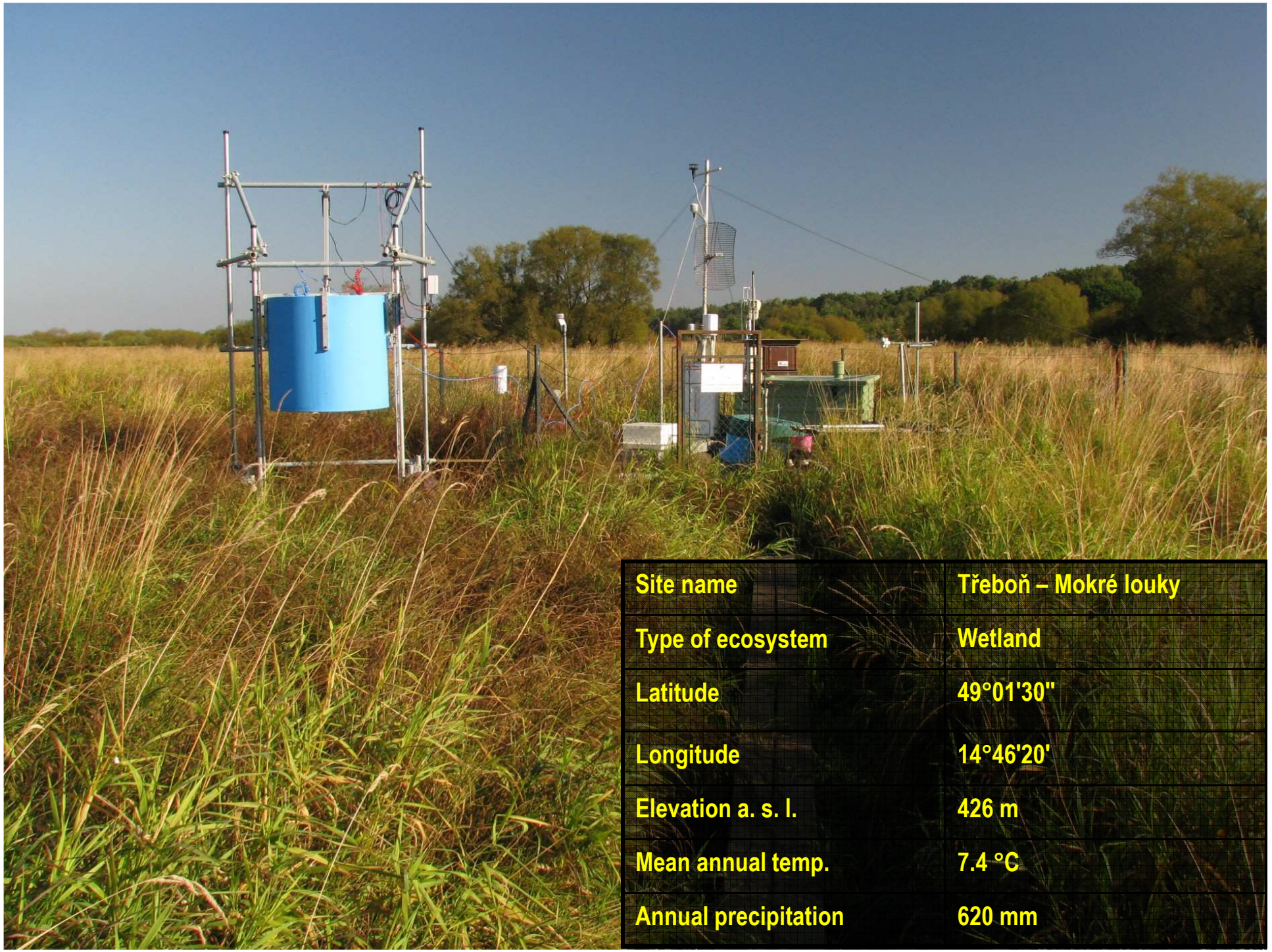
Data stored in 2 levels: final (processed) data and rough data for the possible reprocessing according to the newest procedures.

Ecosystem stations



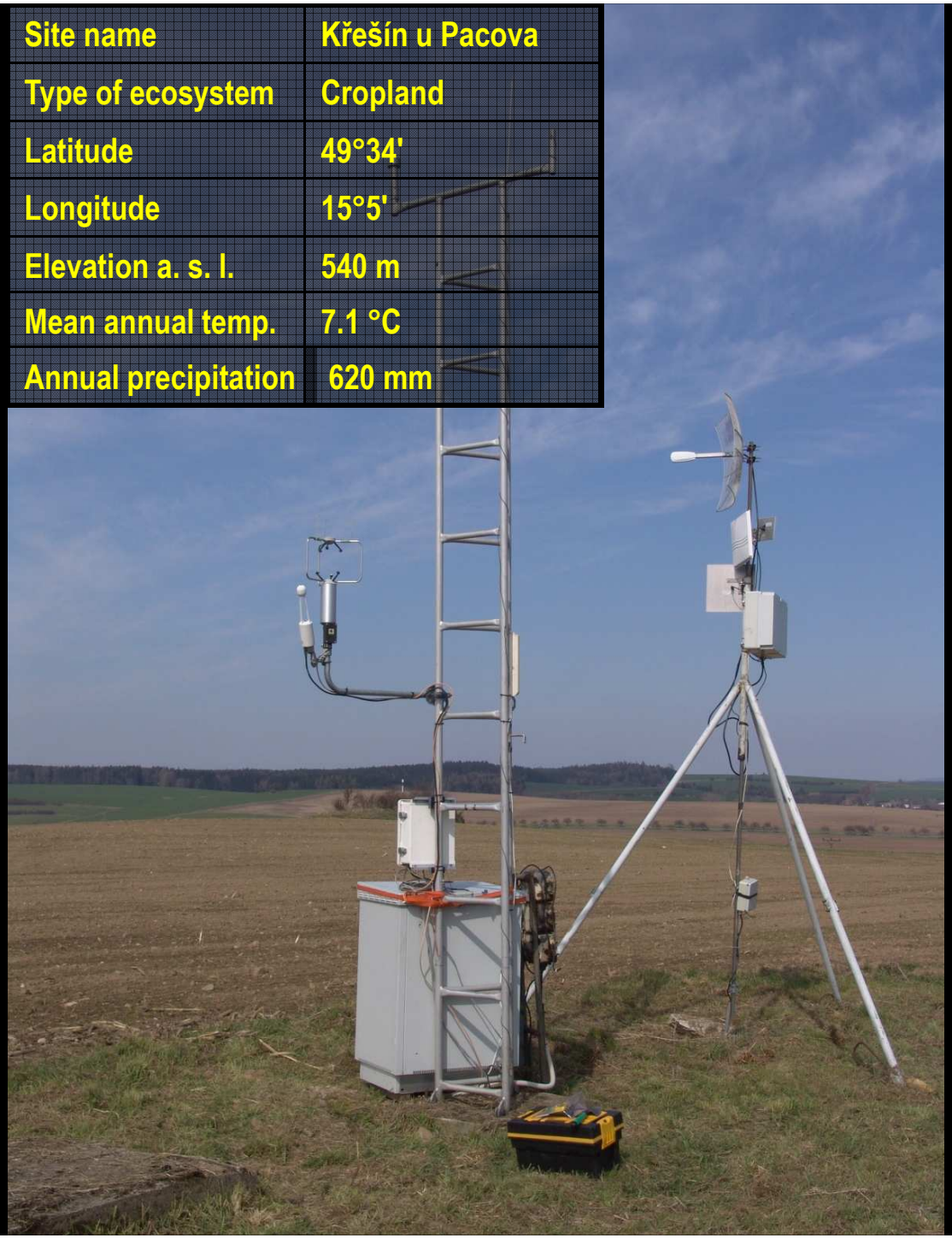
Site name	Bílý Kříž
Type of ecosystem	Spruce forest
Latitude	49°30'17''
Longitude	18°32'28''
Elevation a. s. l.	800-900 m
Mean annual temp.	5.5 °C
Annual precipitation	1000-1400 mm

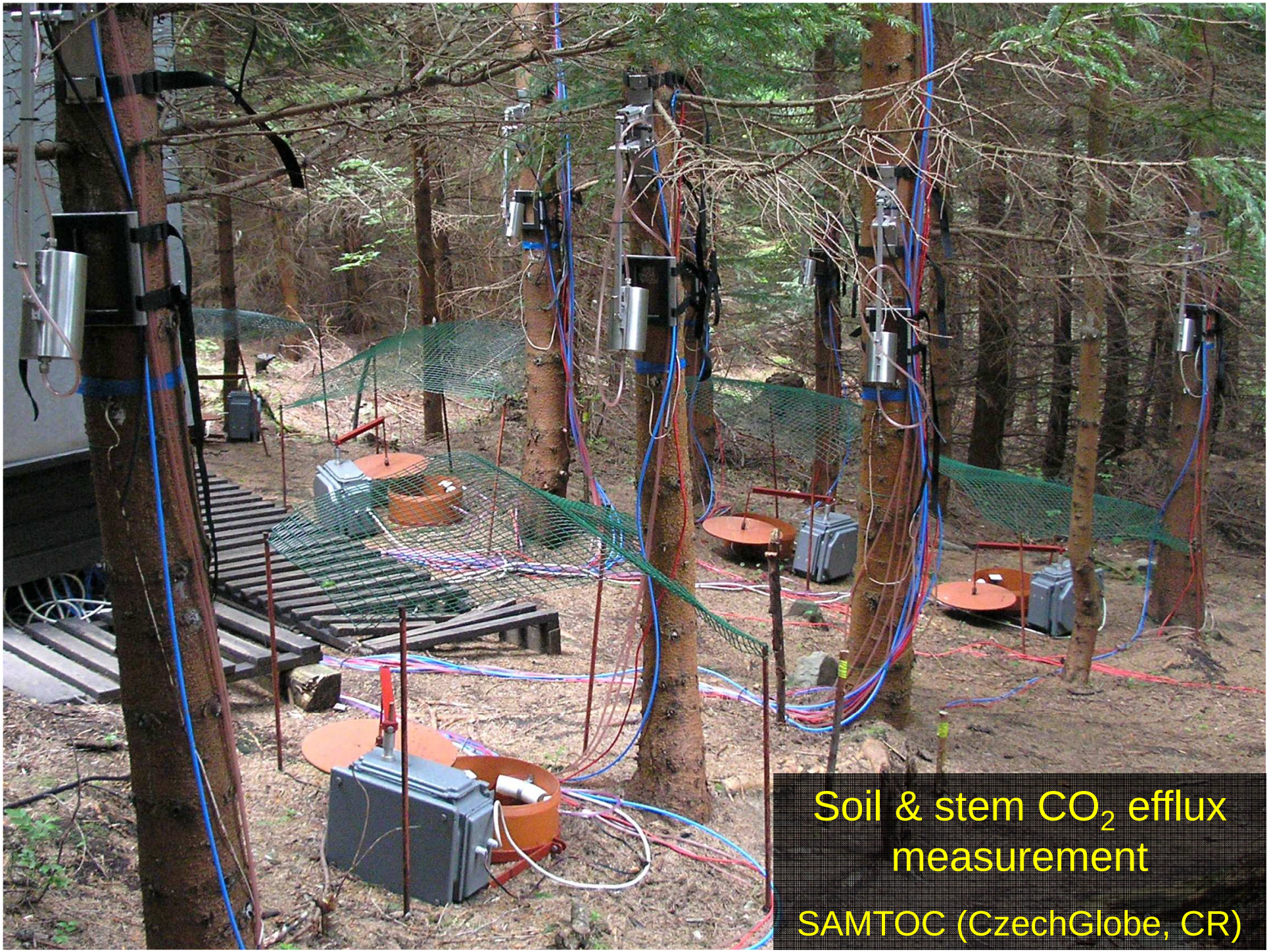




Site name	Třeboň – Mokré louky
Type of ecosystem	Wetland
Latitude	49°01'30"
Longitude	14°46'20'
Elevation a. s. l.	426 m
Mean annual temp.	7.4 °C
Annual precipitation	620 mm

Site name	Křešín u Pacova
Type of ecosystem	Cropland
Latitude	49°34'
Longitude	15°5'
Elevation a. s. l.	540 m
Mean annual temp.	7.1 °C
Annual precipitation	620 mm




Soil & stem CO_2 efflux measurement
SAMTOC (CzechGlobe, CR)

FS Třeboň
Summer flooding

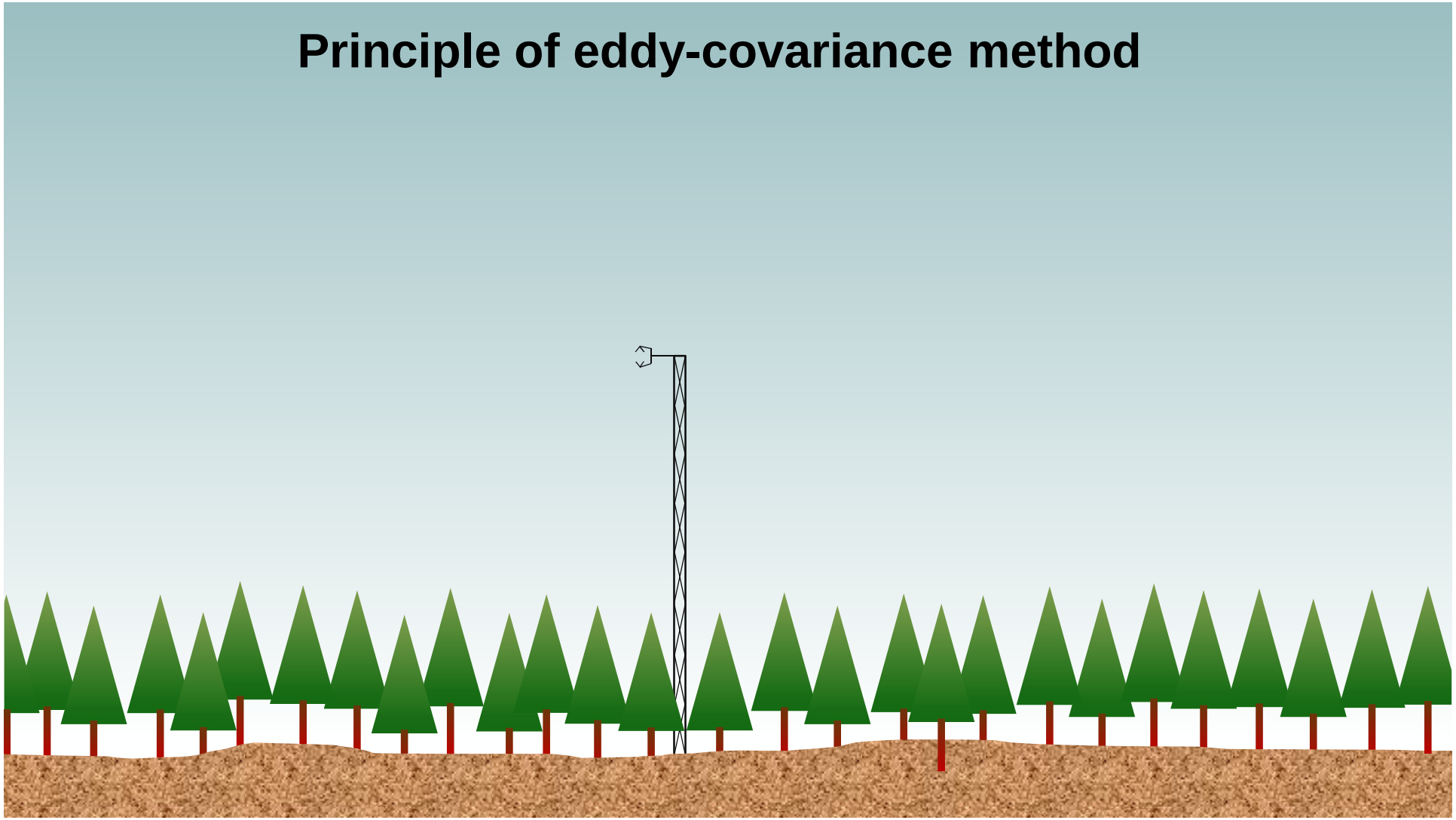
Eddy covariance technique

ultrasonic anemometr

eddy covariance tower

infrared gas analyzer
and control computer

Principle of eddy-covariance method



Equation: $F_C = \overline{w}\,\overline{\rho_C} + \overline{w'\rho'_C}$

average vertical flux — eddy flux

w – vertical component of a wind velocity vector

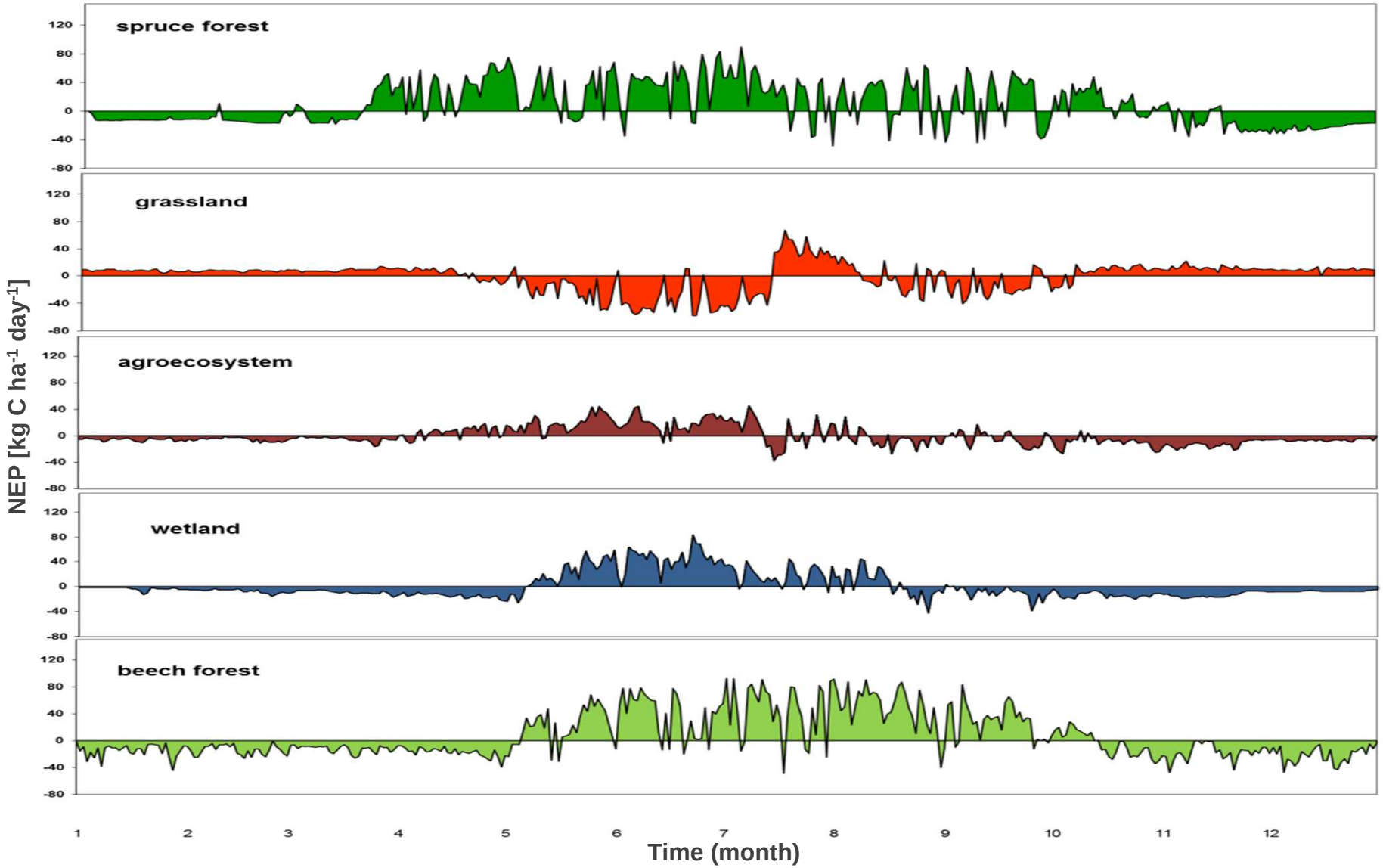
ρ - a scalar (temperature, gas concentration)

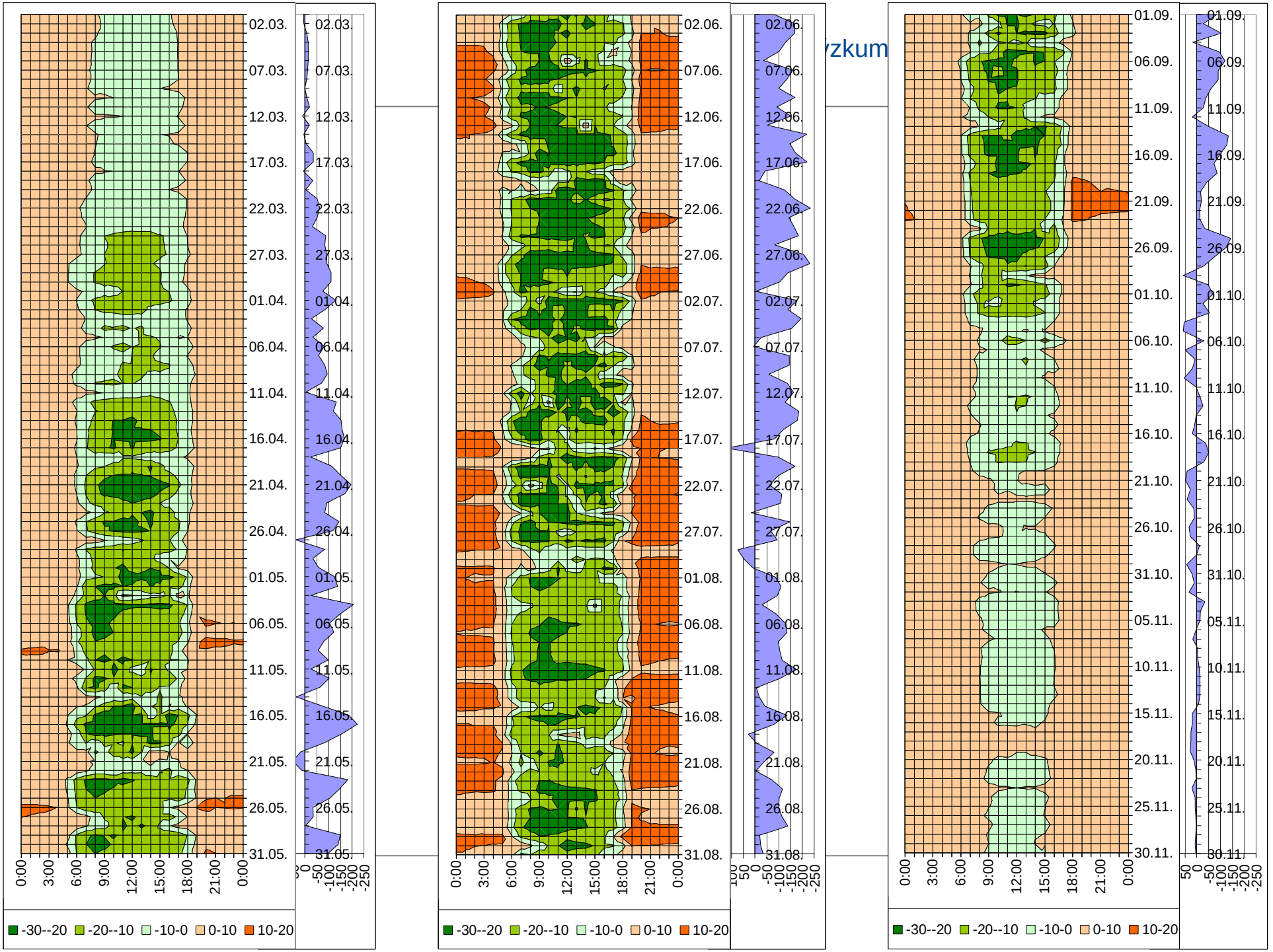
In suitable (long time) interval → $\overline{w} = 0$

Final form : $F_C = \overline{w'\rho'_C}$

eddy flux

Net Ecosystem Production (NEP) of five ecosystems

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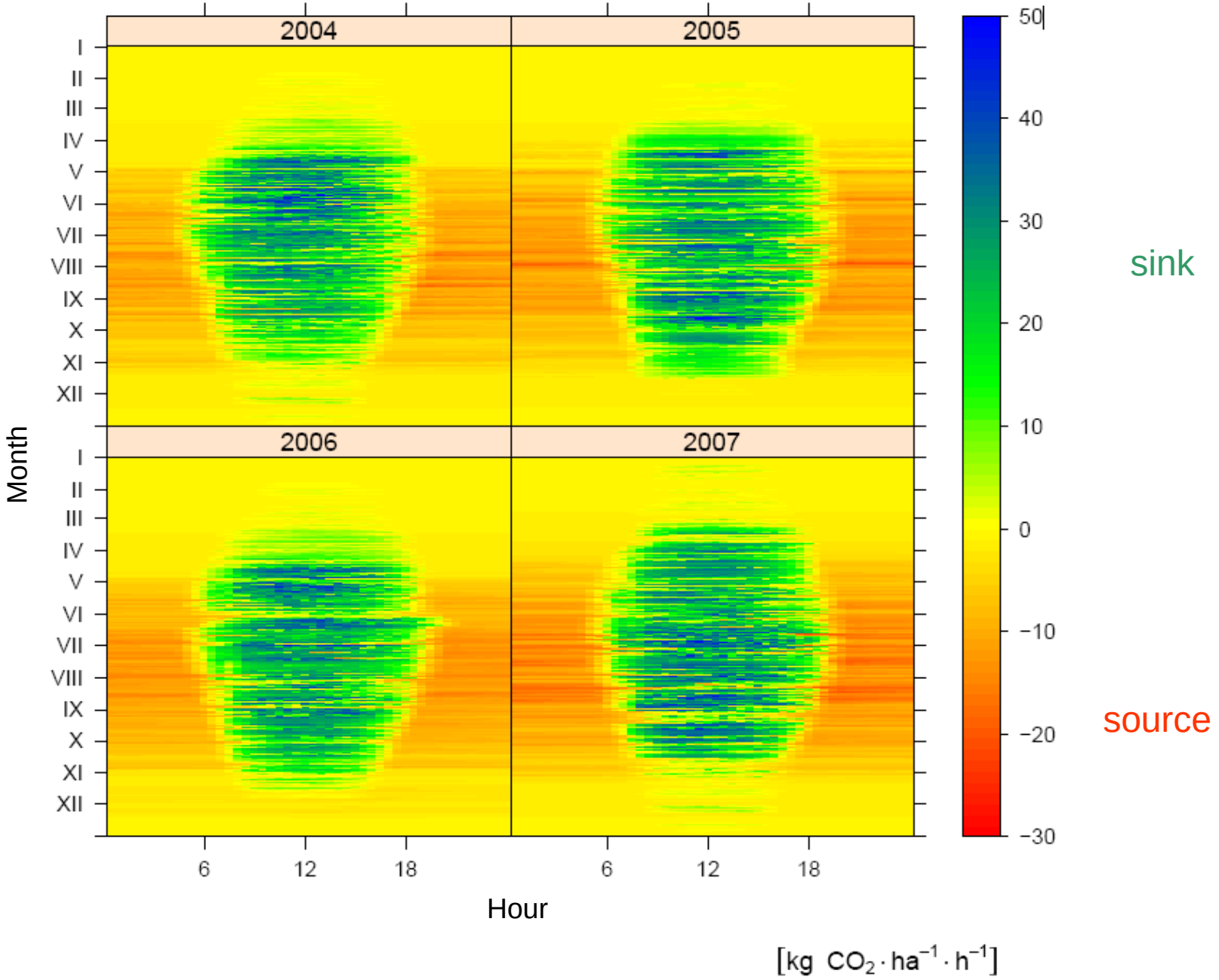
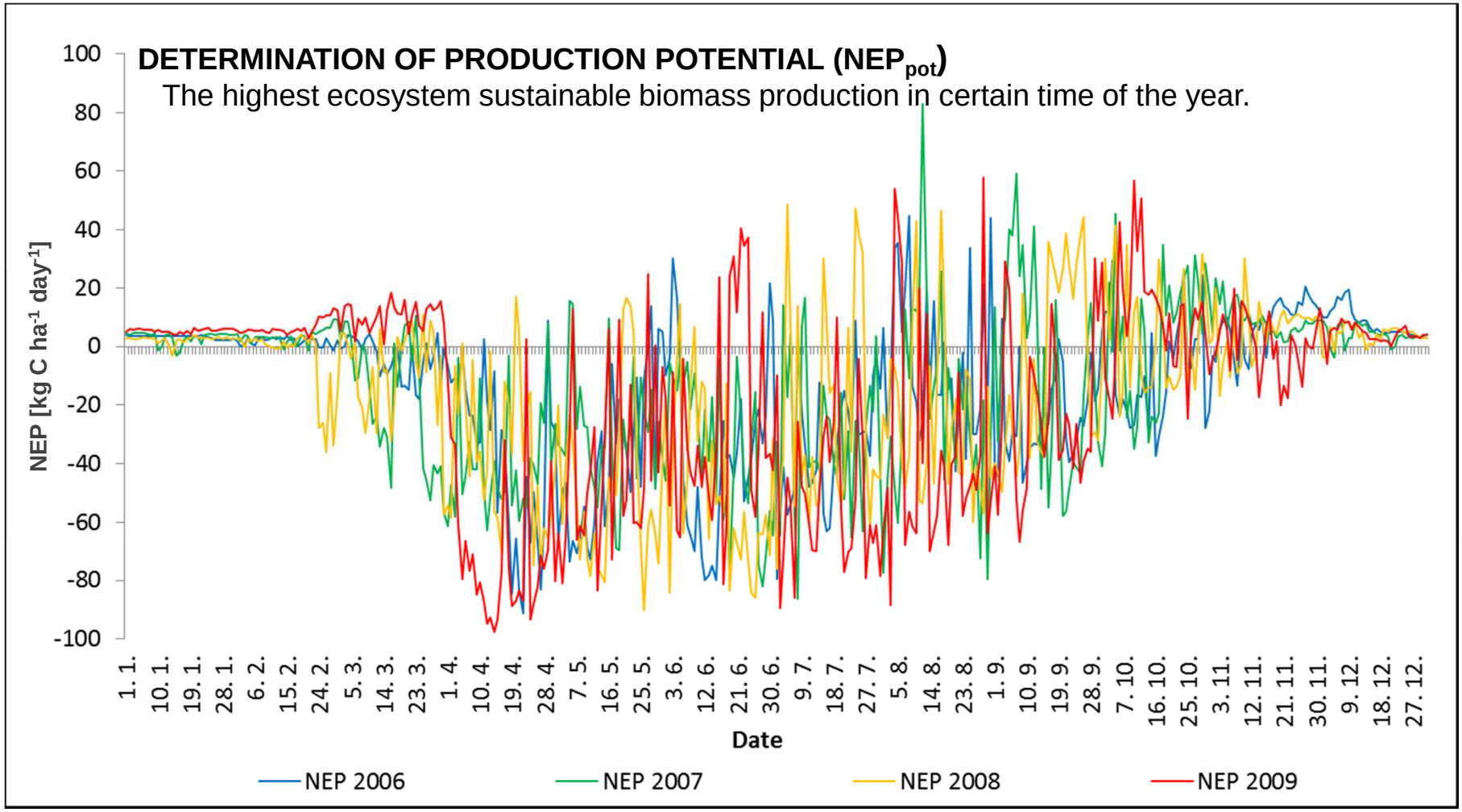
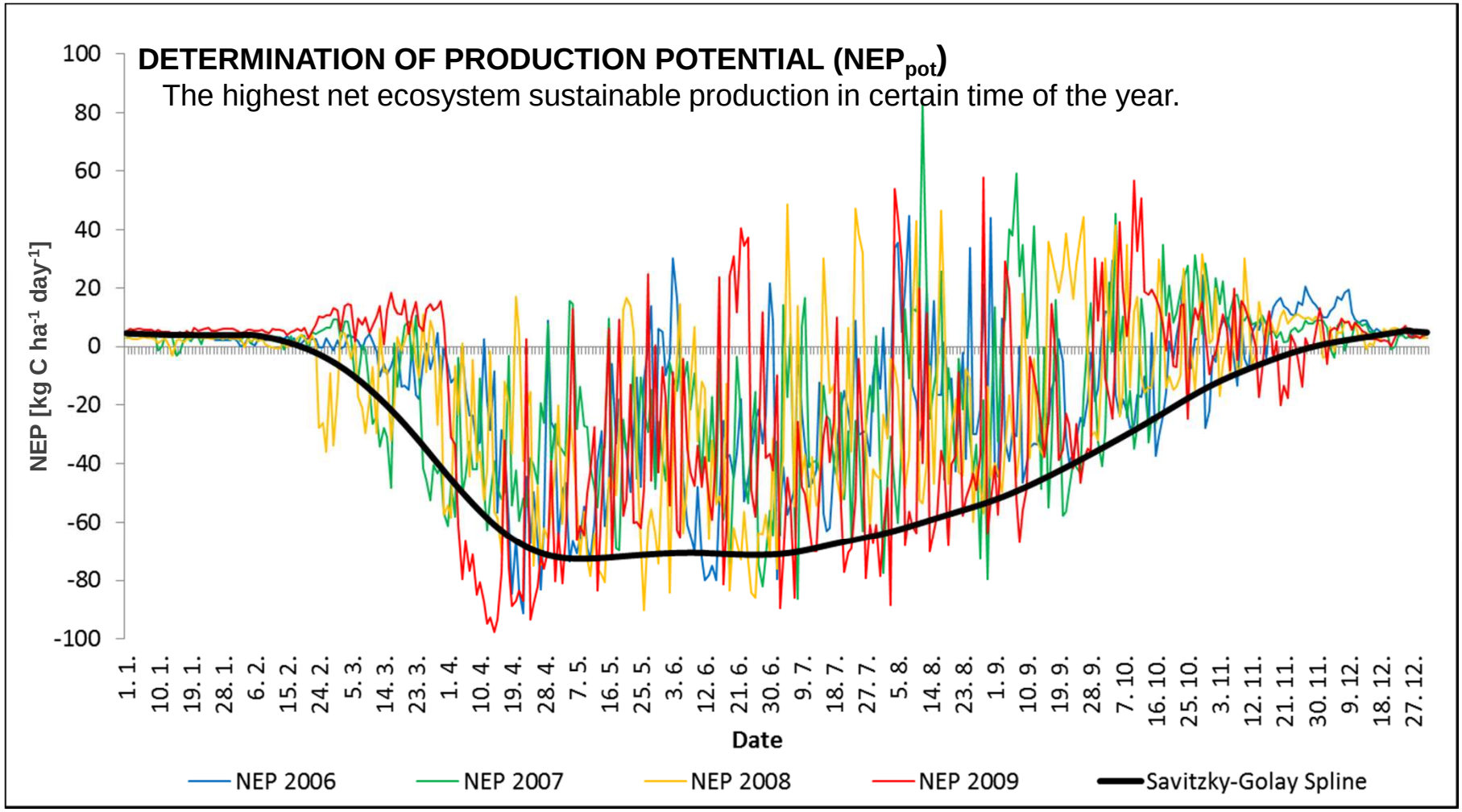
Čistá ekosystémová produkce – horský smrkový les



High production days analyse

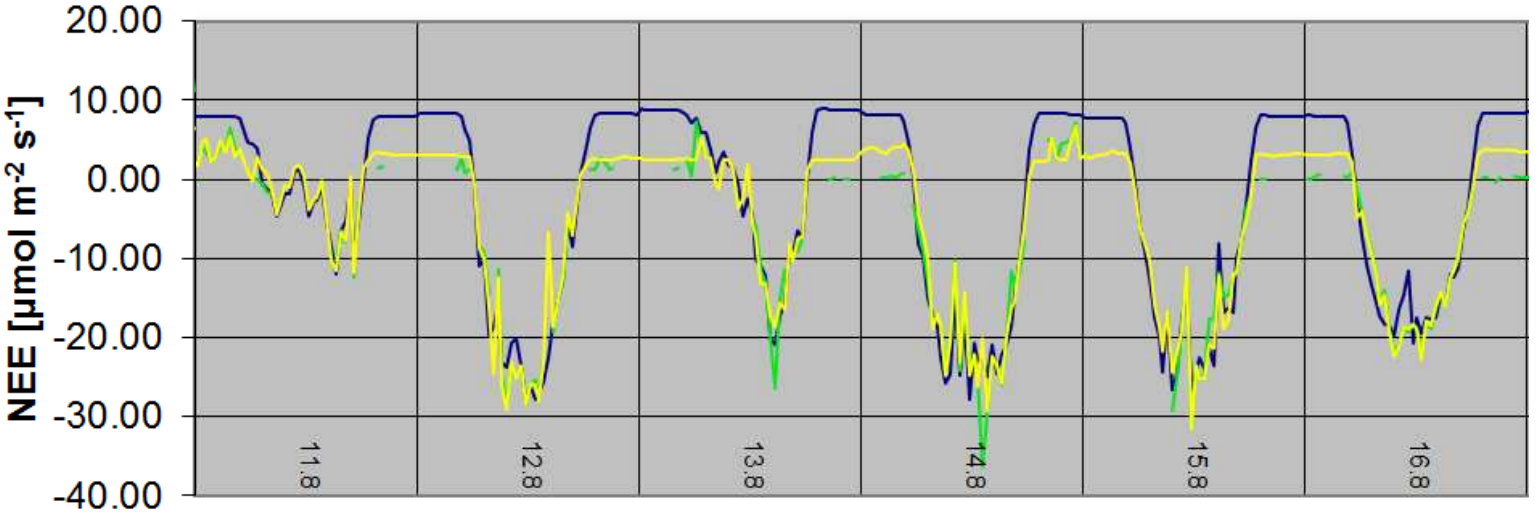


High production days analyse



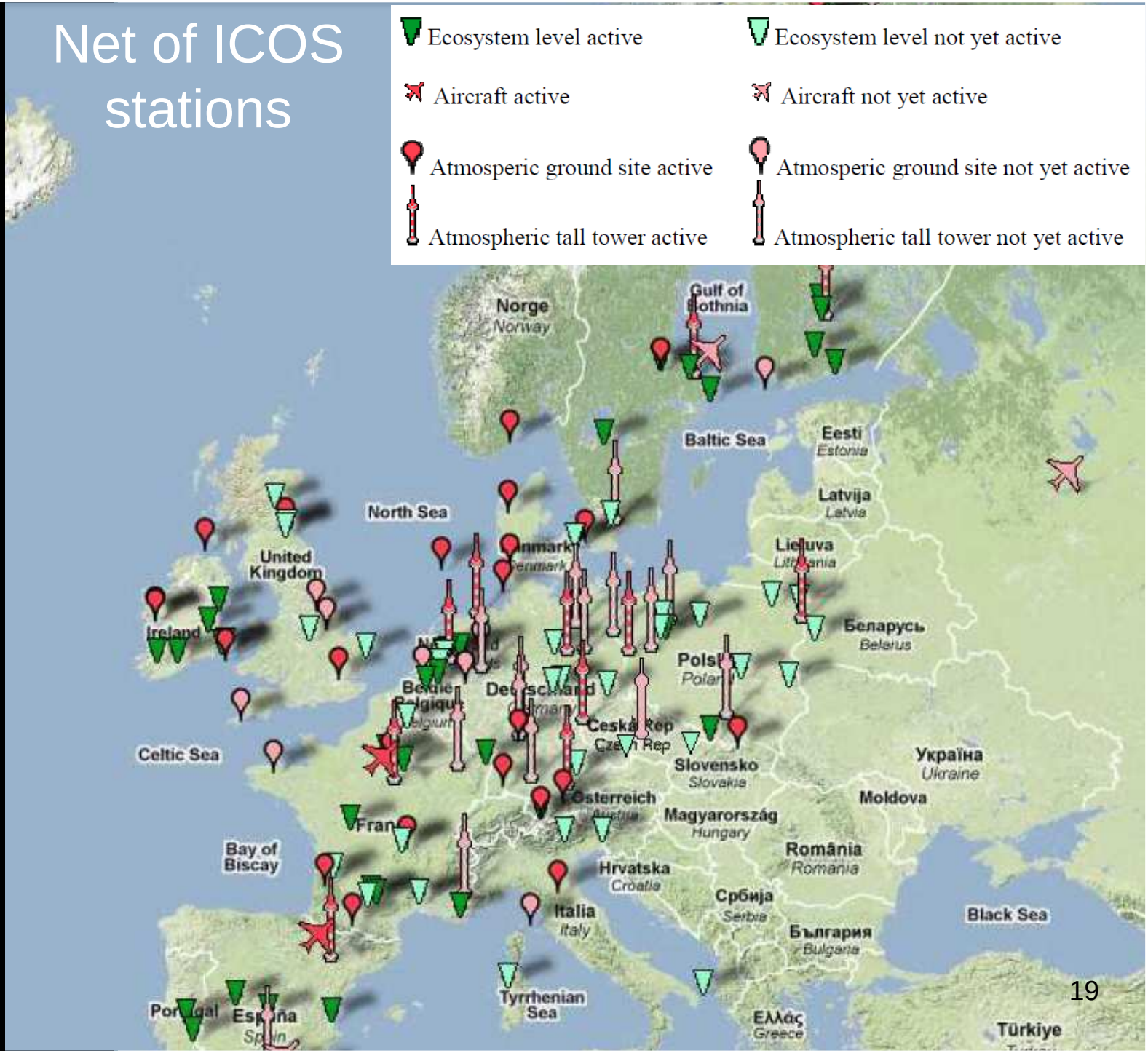
Čistá ekosystémová produkce smrkového porostu v zimním období

Improvement of CO_2 eddy fluxes modelling

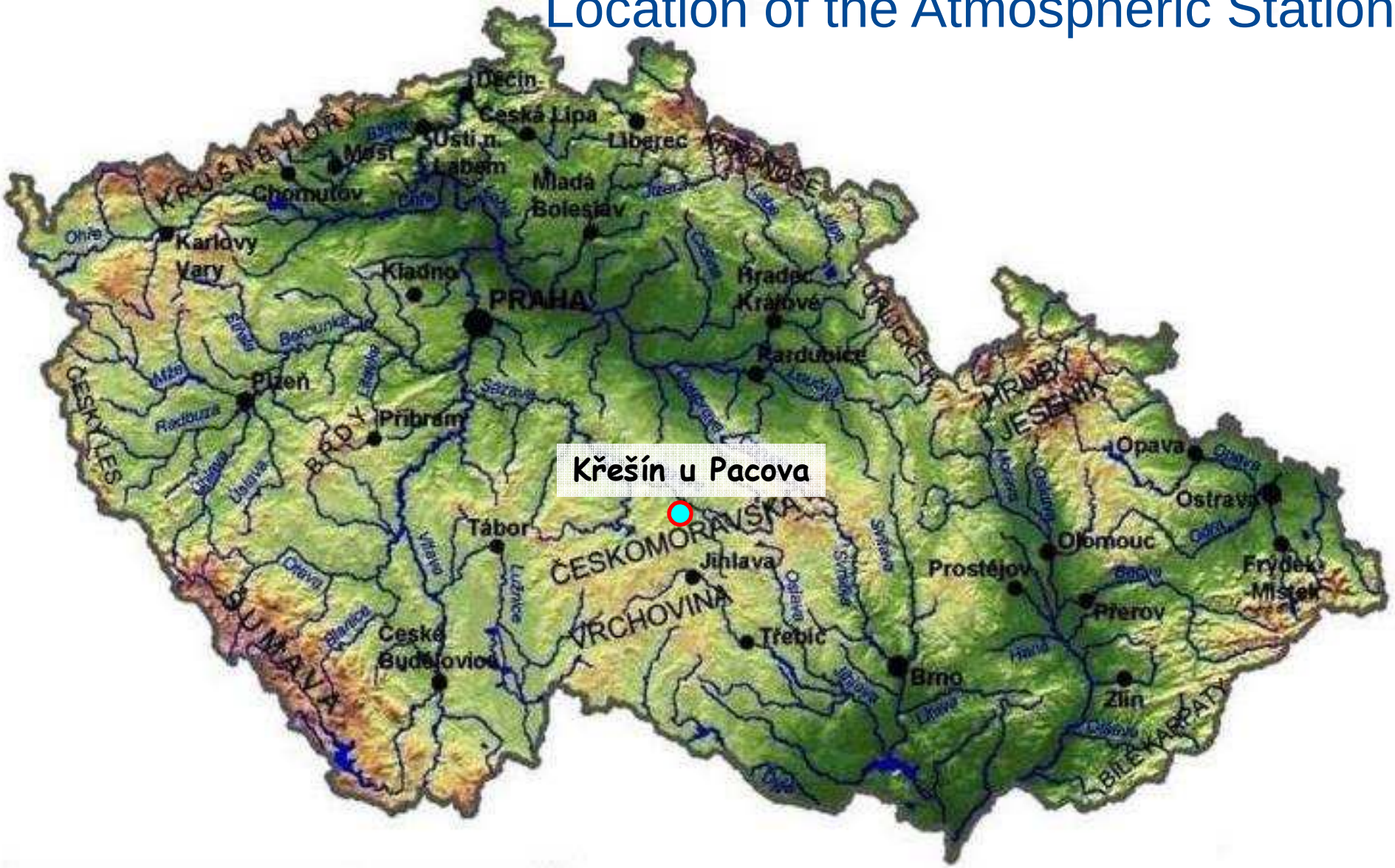


Comparison of computed NEE by CarboEurope-IP method, by new method and measured high quality data.

Net of ICOS stations



Location of the Atmospheric Station



Methods description

Atmospheric station (AS)

under construction

Realize as 250 m high meteorological tower

Continuously monitoring in the frame of **ICOS**:

- conc. CO_2, CH_4, CO (Laser Spectroscopy)
- atmosphere boundary layer (LIDAR)
- basic meteorological characteristics (Ta, RH, P, WS, WD, radiation…)
- periodic air sampling (flask sampling units) → laboratory analyses of selected gases and their isotope composition

Further, the AS will also support research of GCC impact on air quality and long-range transport of atmospheric pollutants (gaseous mercury, aerosols, tropospheric ozone)

The Atmospheric Station Křešín u Pacova and Observatory Košetice (will) represent the Czech Republic in activities under various internatuional projects.

Future studies using data from the AS Křešín

- Temporal trends, seasonality and variability in concentration data series
- Long-range transport of measured species
- Isotope concentration patterns and trends
- Source apportionment of measured species
- Vertical gradients of measured species
- Fate of species in the boundary layer
- and others

For all of this capability of statistics and mathematical modeling is needed.

Co nabízíme?

- Práce na pracovišti s jedinečným vybavením a historií
- Intenzivní mezinárodní spolupráce
- Velké množství kvalitních datových souborů
- Přístup do mezinárodních databází
- Odborný růst
- Kariérní postup
- Genderově citlivý přístup

Co hledáme?

- Skutečný zájem o podstatu problému, vidět za daty biologii
- Iniciativu
- Statistické zpracování dat
- Data mining
- Matematické modelování
  - gap filling
  - aplikace a modifikace současných modelů
  - tvorba nových modelů současného a budoucího chování ekosystémů
  - modely dálkového přenosu látek
  - znalost programování (např.: Matlab, R, Fortran)

Thank you for your attention